

REMARKS

Claims 1- 3, 26, 27, 29, 31, 35, 38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 69 and 71-79 remain pending in the above captioned patent application. Claims 4-25, 28, 30, 32-34, 36, 37, 39, 40, 42, 43, 45, 46, 48, 49, 51, 52, 54, 55, 57, 58, 60, 61, 63, 64, 66, 67 and 70 were cancelled and claim 71 was withdrawn in a Response to Restriction Requirement filed on August 1, 2008 responsive to the Restriction Requirement mailed on July 3, 2008. Claim 71 is hereby cancelled without prejudice to prosecuting the claim later.

Claims 1-3, 26, 27, 31, 35, 38, 72, and 74¹ stand rejected. Claims 29, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 69, 73 and 75²-79 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 3 and 29 has been amended to correct grammatical typographical errors and, in the case of claim 29, an error in antecedent basis, and claims 68 and 69 have been amended to correct the informality noted by the Examiner. Claim 26 has been cancelled as redundant.

Claims 1, 2, 3, 26, 27, 31 and 35 are rejected under 35 U.S.C. 102 (b) as being anticipated by "Fujikata". The Examiner has taken the position that:

With regard to claim 1, Fujikata discloses a photodiode e.g. Fig. 1 comprising: a conductive film 20 having: an aperture 30 having a diameter smaller than wavelength of incident light (e.g. para[0013, 0014, 0032, claim 15]) and a periodic structure (e.g. Fig.

¹ Applicants presume the listing of claims 76-79 as rejected is in error as the Examiner has not in the body of the Office Action specifically addressed any grounds for rejection of claims 76-79 and has indicated that claims 76-79 would be allowable if amended to include limitations of the base claim and any intervening claims. Page 2 of the Office Action also does not refer to claims that have been objected to rather than rejected, such as claims 68, 69 and claims 29, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 69, 73 and 77-79.

² Applicants presume that the Examiner intended to include claim 75, as it is identical to claim 74 except for depending from claim 73.

2A, element 40, para[0044]) provided around said aperture for producing a resonant state (e.g. para[0010]) by an excited surface plasmon (e.g. para[0010]) in a film surface 40 of said conductive film by means of the incident light to said film surface; and a semiconductor layer 21 provided in a vicinity (e.g. Fig. 1) of said aperture of said conductive film and in contact with said conductive film; wherein said photodiode detects near-field light that is generated at an interface (e.g. para[0041]) between said conductive film and said semiconductor layer by said excited surface plasmon.

Fujikata, cited by applicants in an Information Disclosure Statement filed on June 6, 2008, corresponds to Japanese Published Patent Application 2003-287656, which is owned by the assignee of the above captioned patent application. Fujikata is also related to Japanese Published Patent Application 2000-171763, which issued in the United States as US Patent No. 6236033, (the '033 patent). The '033 patent is referenced in the Background of the above captioned patent application.

As noted in the Specification the '033 patent relates to:

"...a device that uses the interaction of incident light and a surface plasmon [such as in the case of the '033 patent] an optical transmission device in which a metal film having an aperture and periodic surface variations is used to greatly enhance the intensity of light that is propagated through the aperture [such that] even with a single aperture, the provision of rows of periodic grooves around the aperture enables greater enhancement of light that is propagated through the aperture than a case that lacks periodic rows of grooves." (Specification, page 6, lines 4-11).

In referring to the disclosure of the prior art Tineke article, the Specification of the above captioned application notes:

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“However, it is known that in surface plasmon resonance, the total energy of transmitted light is attenuated compared to the incident light energy. According to Tineke ... the total energy of light that is transmitted through an aperture having a diameter of 40% of the wavelength or less is attenuated to 1% or less of the incident light energy despite the use of surface plasmon resonance.” (Specification, page 6, lines 11-19).

As a result, as was also pointed out in the Specification of the above captioned patent application:

“...a high SN ratio cannot be obtained in photoelectric conversion even when the optical transmission device disclosed in JP-A-2000-171763 is used to irradiate light that has been propagated from the aperture of the optical transmission device onto a photoreception device.” (Specification, page 6, lines 19-23).

As a solution to this shortcoming of the devices such as are disclosed in Fujikata, JP ‘763 and Tineke, along with the deficiencies of the existing photodiode devices, the claimed subject matter of the above captioned patent application relates in one embodiment to correcting the deficiencies relating to:

“[i]ncreasing the speed of response of a photodiode necessitat[ing] reducing the thickness of the depletion layer to shorten the carrier transit time and reducing the area of the depletion layer to decrease the circuit time constant. However, the adoption of these measures results in a drop in the quantum efficiency of converting the photons of incident light to electron-hole pairs, i.e., the utilization of the signal light [dropping] the SN ratio. In particular, when the size of the window of light incidence is set to a size equal to or less than the wavelength to reduce the area of the depletion layer, the

intensity of light that is transmitted is greatly attenuated due to the diffraction limit Even when an aperture is provided in a metal film, a periodic structure is provided in the metal film in the vicinity of the aperture, surface plasmon resonance is used to raise the intensity of light transmitted through the aperture, and the light that has been thus intensified then introduced into the photodiode, a drop in the SN ratio is observed and sufficient light intensity is not obtained. Even when attempting to detect near-field light that is formed in the vicinity of an aperture provided in a metal film, it is believed that the relatively low light absorption coefficient of the semiconductor material that makes up the photodiode prevents sufficient light intensity from being obtained.

In this type of photoreception device, the dark current that flows even in the absence of a signal light becomes a problematic source of noise. Dark current flows as a result of the generation of charge carrier due to heat and the like and is therefore highly dependent on temperature. The greater the volume of the region that generates electron-hole pairs, the greater the dark current. The inability to implement lattice matching of the metal and semiconductor in a Schottky photodiode further produces a type of lattice defect in the depletion layer. This defect acts as the generation center of charge carrier and thus acts to increase dark current.” (Specification, page 9, line 15—page 10, line 17).

Therefore, as noted in the Specification of the subject patent application, in order to overcome these shortcomings of the prior art the claimed subject matter in one embodiment relates to:

“ a photodiode [that] includes: a conductive film having an aperture having a diameter smaller than the wavelength of incident light and a periodic structure provided around

the aperture for producing a resonant state by an excited surface plasmon in a film surface of the conductive film by means of the incident light to the film surface; and a semiconductor layer provided in the vicinity of the aperture of the conductive film and in contact with the conductive film; wherein the photodiode detects near-field light that is generated at an interface between the conductive film and the semiconductor layer by the excited surface. ... "(Specification, page 10, lines 26—page 11, line 8).

According to another aspect of the disclosed subject matter recited in the claims of the subject patent application:

"[t]he region in which a Schottky barrier formed by the conductive film and the semiconductor layer appears preferably substantially matches a region of generation of the near-field light." (Specification, page 10, lines 10-13).

The Examiner's rejection of claims 1, 2, 3, 26, 27, 31 and 35 under 35 U.S.C. § 102 (b) over Fujikata is improper since Fujikata does not even disclose one of the operative elements of the claims, namely, a photodiode. Fujikata discloses an optical device and an optical head using it. The layers of conductive film 20 enclosing the intermediate layer 21 of Fujikata do not form a diode at all. There is no disclosure of the application of a junction voltage across the layers of Fujikata nor forming such a junction in the vicinity of the hole 30 in the layers 20, 21 of Fujikata.

The Examiner has in fact admitted this in allowing claims 29, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 69, 73 and 75³-79, if rewritten to include the recitations of parent claims, as these claims more particularly point out and clearly recite aspects of the claimed subject matter

³ Applicants presume that the Examiner intended to include claim 75, as it is identical to claim 74 except for depending from claim 73.

relating to forming a photodiode in a junction depletion region the layers underlying the aperture of the claimed subject matter.

Therefore the Examiner's rejections of claims 1, 2, 3, 26, 27, 31 and 35 under 35 U.S.C. § 102 (b) over Fujikata is improper and the Examiner is respectfully requested to withdraw the rejection of claims 1, 2, 3, 26, 27, 31 and 35 under 35 U.S.C. § 102 (b) over Fujikata and allow claims 1, 2, 3, 26, 27, 31 and 35.

Turning to the 103 rejections claim 38 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Fujikata in view of United States Published Patent Application No. 20030011722, ("Fujikata II") . Claim 72 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Fujikata in view of "Scruggs". And, claim 74 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Fujikata in view of Scruggs et al and further in view of Ojima et al. All of these claims are directly or indirectly dependent on claim 1, or linked to claim 1. The deficiencies of Fujikata vis-à-vis claim 1 are discussed above. Regardless of the Examiner's characterizations of the teachings of Fujikata II, Scruggs and/or Ojima, none of the secondary references alone or in combination supply the missing teachings to Fujikata to achieve or render obvious claim 1. Thus, no combination of the applied art can be said to achieve or render obvious claim 1 or any of the claims which depend on or are linked to claim 1.

Claim 29, which the Examiner has indicated as allowable, has been rewritten in independent form as new claim 80. New claims 81-84 are directly or indirectly dependent on new claim 80 and further scope claim 29.

New claims 85-93 have been added to further scope the invention.

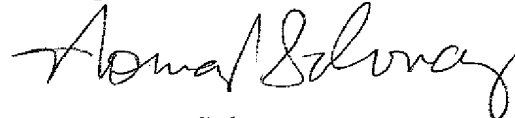
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Added claim fees are being paid via EFS WEB in the amount of \$960.00 (ten total added claims and two added independent claims).

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account Number 08-1391.

Respectfully submitted,



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I hereby certify that this correspondence is being deposited with the United States Patent Office via the electronic filing procedure on February 25, 2009.

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